SPAIN INDIA 2020

A joint reflection on the past, present and future of our bilateral relations

WORKING PAPER 4

Urban development and sustainability

FUNDACIÓN CONSEJO ESPAÑA INDIA | SPAIN INDIA COUNCIL FOUNDATION

WITH THE COLLABORATION OF

Indo Spanish Chamber of Commerce

Project-manager and author: Cristóbal Alvear
Coordination and production: Berta Fuertes and Vega Yubero, Spain-India Council Foundation
Documentation and revision: Mikel Herrera
Design and layout: www.nolsom.com
Translation from original Spanish

Madrid, October 2020

C/ Serrano Galvache, 26.
28033 Madrid
www.spain-india.org

Visit to the Valdemingómez waste management park during the 1st Spain-India Forum.

4.1.

Framework of bilateral relations in the field of urban development and sustainability

Urban development and sustainability are areas in which, to date, there has been major interest for collaboration between both countries, albeit not having developed their great potential. At a governmental level, two MoUs have been signed on renewable energies, in 2009 and 2017, and one on climate change and clean development mechanism projects, in 2008. However, these agreements have not had the expected follow-up or implementation, despite being sectors of great bilateral outreach. In other sectors, such as water resources or sustainable urban development, both administrations have shown interest and availability in expanding this network of agreements, reaffirming that the sectoral synergies between both countries remain valid.

At an institutional level, collaboration between public bodies has grown in recent years. In 2016, an agreement was signed between the National Centre for Renewable Energies (CENER) of Spain and the National Institute of Wind Energy (NIWE) of India. In 2017, there were agreements on regional rapid transit systems between the Railway Infrastructure Administrator (ADIF) of Spain and the National Capital Region Transport Corporation (NCRTC); between the Embassy of Spain in India and the University of Virginia (US) on the recovery project for the Yamuna River; between the Spanish Photovoltaic Union (UNEF) and the National Solar Energy Federation of India (NSEFI); as well as the partnership and cooperation agreement between the cities of Valladolid and Ahmedabad.

A number of initiatives, such as the two editions of the Spain-India Forum, promoted by the Spain-India Council Foundation, or several editions of its Indian Leaders Programme, have also been carried out in these sectors. Large Spanish companies such as Acciona, Siemens Gamesa, Grupo Mondragón, Ayesa, CAF, Indra, Eptisa or Urbaser participate in flagship projects in both urban development and sustainability in India (see Illustration 29).

However, there are still enormous opportunities for the internationalisation of leading companies in both countries and for their SMEs, participating in sustainable urban development projects in which they have shown that they can be partners in innovation. India's exponential urban growth makes sustainability challenges pressing, including issues such as pollution or water resources, for its 53 cities with more than one million inhabitants and 19 cities with more than two million, according to the 2011 census, and of its 6 metropolitan areas with more than 10 million in 2020 (see Illustration 30). Cooperation between Spanish and Indian cities, relationships which have not yet been sufficiently explored and with a great multiplying component, could be one of the main driving forces to boost relations at an urban level and to promote joint initiatives of smart cities to turn the cities of both countries into 4.0 sustainable cities.

Visit to the greenhouses of Pulpí (Almería) during the 2018 Indian Leaders Program.

ILLUSTRATION 29 / **Main projects in the field of sustainability and urban development in which Spanish companies have participated in India**

Spanish company	Participation in development and urban sustainability projects in India
Abengoa	Desalination plant in Chennai
Acciona	Four operating wind parks and three under construction
Ayesa	Delhi-Meerut Regional Rapid Transport System (RRTS), Noida-Greater Noida corridor and metros of Delhi and Mumbai
CAF	Airport Express Line of Delhi
Eptisa	Second phase of the National Hydrology Project of India and the Smart Cities Mission
Idom	East Delhi Hub and the India International Convention & Expo Centre (IICC)
Indra	Airport Express line of Delhi and the metros of Delhi, Mumbai and Kolkata
LKS Krean (Grupo Mondragón)	Masterplan of Mazagon Dock Mumbai and Panaji, ecological restoration of the rivers Cooum and Adyar, smartcity of Solapur
Siemens-Gamesa	Development of the first hybrid wind-solar business park in Karnataka
Urbaser	Collection and transportation of solid waste and urban cleaning in Chennai

Source: Own elaboration based on the websites and annual reports of the companies

ILLUSTRATION 30 / **Indian cities with more than one million inhabitants as per the 2011 census and main metropolitan areas in 2020**

	Metropolitan Area	Population in 2011, in millions
1	Mumbai	18.4
2	Delhi	16.3
3	Kolkata	14.1
4	Chennai	8.7
5	Bangalore	8.5
6	Hyderabad	7.7
7	Ahmedabad	6.4
8	Pune	5.1
9	Surat	4.6
10	Jaipur	3
11	Kanpur	2.9
12	Lucknow	2.9
13	Nagpur	2.5
14	Ghaziabad	2.4
15	Indore	2.2
16	Coimbatore	2.1
17	Kochi	2.1
18	Patna	2
19	Kozhikode	2

	Metropolitan Area	Population in 2020, in millions
1	Delhi	30.3
2	Mumbai	20.4
3	Kolkata	14.9
4	Bangalore	12.4
5	Chennai	11
6	Hyderabad	10

Sources: Indian Census 2011; CIA Factbook

4.2.

Twinnings, exchanges and cooperation between Indian and Spanish cities

Exchanges between Spanish and Indian cities are scarce and not very continuous. If we take Germany as a reference, the cities of Mumbai and Stuttgart have been twinned since 1968, and Coimbatore and Esslingen am Neckar since 2008, with continuous exchange and bilateral cooperation activities. At a regional level, the states of Karnataka and Bavaria have had a cooperation agreement since 2007 and the states of Maharashtra and Baden-Württemberg signed an MoU in 2015 to establish their twinning. These relationship frameworks have been followed by visits by Ministers, MPs and businessmen from these states, who have established a cooperation and exchange network at the state and municipal level with a significant impact at the investment, cultural and educational level. Far from being a mere formal agreement, these town twinnings have become efficient tools to enhance cultural and business relations between both countries.

At an Indo-Spanish level, this municipal cooperation model only has as one example in the twinning between the cities of Ahmedabad and Valladolid in 2017, the only one approved to date under the 2014 official twinning model established by the Government of India, which requires the approval by the Indian Ministries of Urban Development and External Affairs. The alliance between Ahmedabad and Valladolid has shown how institutional cooperation at a municipal level has a multiplying effect in sectors such as education, civil society or business (see In Detail 10). The difference between government structures of Indian and Spanish cities makes institutional exchanges difficult. In most Indian cities, the mayor is the head of the municipal corporation from an honorary point of view, but executive powers are held by one or more municipal commissioners, depending on the different corporations into which the metropolitan area is divided, which are normally held by high State officials. Municipal dialogue, as in the case of the cities of Ahmedabad and Valladolid, must be carried out at both levels.

The last contacts between Spanish and Indian cities have been carried out between Murcia and Solapur, and Cáceres and Jaipur. Within the European programme for International Urban Cooperation (IUC) in Asia, the cities of Murcia and Solapur signed a collaboration agreement in 2018 to constitute the “International Working Group for the Murcia-Solapur exchange of best practices”. The agreement, with ERDF funding and which will allow the transfer of best practices and the development of a Local Action Plan, focuses on the areas of urban governance and regeneration, public spaces and services, and water management. A delegation from Solapur visited Murcia to learn about the water treatment systems applied by the city and the use they make of information and communication technologies to improve the management and provision of public services. Also, in 2018, the cities of Jaipur and Cáceres began the procedures for their twinning, but these have not been finalised to date.

The cities of Madrid and Barcelona make up the gateway to Spain for numerous Indian delegations. The innovative projects of the two main Spanish cities at an urban level are the main showcases for representatives of the main Indian administrations and institutions to get to know first-hand about their innovative capacity and smart solutions in areas such as mobility or urban waste management (see Case 8). However, there are no institutional frameworks for cooperation between Madrid and Barcelona and the main Indian cities, such as Delhi and Mumbai, which could promote joint projects to develop this enormous bilateral potential.

Visit to Azkuna Zentroa in Bilbao during the 2016 Indian Leaders Program.

IN DETAIL 10

Successful cooperation between Valladolid and Ahmedabad

The creation of Casa de la India in 2003, with head office in Valladolid, and with the participation of the Indian Institute for Cultural Relations (known by its acronym ICCR), the City Council of Valladolid and the Embassy of India, established a permanent bridge between Valladolid and India. During these first years, a **stage of awareness** began between Ahmedabad and Valladolid, culminating with the visit of a delegation from the city of Ahmedabad to Valladolid in 2008, where a collaboration agreement was signed in the fields of heritage conservation and cultural and tourism promotion.

The next **stage of sectoral exchanges** was marked by cooperation in the areas of architecture, heritage and urban planning. These exchanges began with the organisation in Valladolid of the exhibition “Discovering Ahmedabad: Chronicle of a Human Reinvention”, and of the conference “Architectural Heritage of Ahmedabad” in 2009, and in Ahmedabad of the exhibition “Valladolid, Heritage and Light” and the conference on architecture and sustainable development at the Ahmedabad Heritage Week in 2010. In 2011, the company from Valladolid, **GMV**, developed and implemented an Intelligent Transportation Management System (ITMS) for Ahmedabad. GMV's project improved the management of public transport, providing the necessary technological infrastructure for the monitoring, regulation and control of the bus fleet. Between 2013 and 2016, the project "Cultural Heritage and Management Venture Lab in Ahmedabad" was developed, with Europeaid funding, in which Valladolid and Ahmedabad collaborated in the creation of a sustainable model for the management of cultural heritage.

With the signing of the official twinning protocol between Ahmedabad and Valladolid in 2017, which started with the visit of the mayor of Valladolid to India in 2016, a new **stage of holistic and permanent cooperation** between the two cities began. This commitment has had a multiplying effect in many areas. The University of Valladolid has given new impetus to the exchanges with the University of Ahmedabad, its main partner in India for both agreements and student exchanges. The Spanish Chamber of Commerce has identified the Valladolid Chamber of Commerce as a specialised chamber in India with the creation of the India Help Desk for Business Solutions. And the **Valladolid Film Office (VAFO)** has placed India as a priority market for the attraction of locations.

CASE 8

Madrid and Barcelona, bridges of urban innovation between Spain and India

The IESE Cities in Motion Index 2020 ranked **Barcelona and Madrid among the 30 smartest and most sustainable cities of the world**. Madrid stands out in terms of mobility and transport and its international outreach, including its commitment to sustainable urban development and the conversion of the city centre into a pedestrian area and its aid scheme to replace polluting vehicles. Barcelona is a leader in its performance in mobility and transport; in urban planning, with an advanced implementation of receptive technologies in urban systems; in its ranking as one of the cultural, economic and financial centres of Europe, in addition to being the leader in Spain in terms of registered electric vehicles. Barcelona became the first city in the world to have a public network of laboratories –Laboratorios Fab–, in which citizens play a key role in the development of intelligent proposals.

In the field of mobility, the **M3-Madrid Movement for Mobility** project plans to create a mobility hub to turn Madrid into an entrepreneurial ecosystem in areas such as autonomous and connected vehicles, infrastructures for electric charging and alternative fuels or shared mobility. In the field of sustainability, **MADRID 360** is an initiative that promotes mitigating nitrogen oxides by promoting green transport, reducing traffic of polluting vehicles in the city centre or eliminating coal boilers in the city by the 1st January, 2022.

Topping the **smart initiatives in the field of mobility** in Barcelona we have projects such as the introduction of hybrid buses, solar panels in the canopies and a network of efficient routes in the Barcelona transport system, allowing more frequency and 95% of its trips being carried out with a maximum of one transfer between any two destinations in the city. Among the many initiatives in the field of **innovation for sustainability**, Barcelona has developed pioneering projects, such as the expansion of smart containers that use a vacuum system to extract underground waste, a low-energy smart public lighting system based on LEDs to adjust the intensity of light or a network of sensors that detect noise levels, atmospheric pollution, temperature and humidity.

Madrid and Barcelona are also the gateways in Spain and Europe for numerous **Indian delegations interested in innovation and the implementation of information technologies in urban areas**. The **Indian Leaders programmes**, promoted by the Spain-India Council Foundation, show the synergies and complementarities that innovation projects in urban areas in Madrid and Barcelona can bring to India. In 2019, Indian leaders in the field of innovation and entrepreneurship visited La Nave, one of the innovation spaces promoted by Madrid, as well as Barcelona Tech City, a centre for the creation of hi-tech companies. Previous delegations of Indian leaders have visited other flagship projects at an urban level such as the Valdemingómez Technological Park for urban waste in Madrid, or District22 @ in Barcelona.

The Mobile World Congress and the Smart City Expo World Congress, held in Barcelona, are the main global platforms for dialogue and exchange in terms of information technology and smart cities. FITUR, held in Madrid, is the main world fair of the sector in innovation and implementation of information technologies for tourism. These congresses and fairs have become **excellent platforms for the visiting Indian experts to get on-site information about the outstanding initiatives and projects** of Madrid and Barcelona in urban innovation.

To make the most of the position of Barcelona and Madrid as bridges for urban innovation between Spain and India, **permanent spaces for bilateral sectoral dialogue on sustainable urban development and innovation** could be organised on the sidelines of these meetings. These spaces for bilateral dialogue would make it possible to promote mutual knowledge, exchanges between civil society fabrics and the development of joint collaboration projects. Likewise, taking into account that bilateral relations at a municipal level still have a lot of potential to be explored, these spaces would serve to encourage an institutional strengthening of the relations between Madrid and Barcelona and the main Indian cities, including Delhi and Mumbai.

4.3.

Bilateral opportunities to address urban mobility challenges

Spanish cities, which faced an exponential expansion of their population and the subsequent urban growth in the last third of the 20th century, have extensive experience in urban development and innovative solutions for sustainability. The similarity between the urban challenges of Indian cities today and those faced by Spanish cities a few years ago generates urban synergies, unexplored in many cases. However, the Indian magnitude reaches extraordinary dimensions, such as the metropolitan area of Delhi, with around 30 million inhabitants, the largest in India today. Despite the major projection for the development of urban mobility infrastructure in India, with more than 500 kilometres of metro network under construction, this urban growth generates major mobility issues. For example, it takes 70% of the Indian youth more than one hour to commute in the major cities, where their preferred mode of transport in the three main metropolitan areas is public transport (see Illustration 31). In this regard, the main problems perceived by the Indian urban population are the quality of infrastructures, the frequency of service or the lack of uninterrupted services (see Illustration 32).

Within this urban infrastructure development that India is currently undertaking, the opportunities for bilateral collaboration are innumerable, as shown by various initiatives. The 1st Spain-India Forum organised by the Spain-India Council Foundation in 2014 on "Sustainable cities and transport networks for the next generations", with the participation of representatives of public bodies from Delhi, Chennai, Bangalore or Ahmedabad, showed the synergies in urban

ILLUSTRATION 31 / **Urban mobility indicators of the Indian youth**

Transportation preferences for youth commuting in main Indian cities in 2018	Public transport	Personal 2-wheeler	Personal 4-wheeler	Private cab service
Kolkata	**55%**	19%	16%	9%
Mumbai	**52%**	26%	16%	6%
Delhi	**42%**	24%	26%	7%
Bangalore	34%	38%	17%	12%
Hyderabad	27%	46%	15%	12%
Chennai	23%	49%	23%	6%

Distribution of travel time for urban youth commuting in main Indian cities in 2018	No travel	Less than one hour	1-2 hours	2-4 hours	More than 4 hours
Delhi	5.3%	26.2%	**39.6%**	18.4%	10.5%
Mumbai	6.2%	25.6%	**38.7%**	17.6%	11.9%
Hyderabad	11.6%	22.7%	**34.3%**	18.2%	13.2%
Bengaluru	7.4%	27.8%	**34.2%**	21.2%	9.4%
Kolkata	4.1%	26.5%	**37.8%**	20.4%	11.2%
Chennai	16%	22.6%	**32.6%**	13.8%	14.9%

Source: YouGov-Mint

ILLUSTRATION 32 / **Urban mobility indicators in India and Spain**

Urban population	Spain	India
Urban population in 2019, in millions	38	471
Urban population in 2019, % of total population	80.6%	34.5%

Urban mobility	Spain	India
Metro network, in km	580	679
Metro travellers in 2019, in millions	1,275	2,6
Urban bus travellers in 2019, in millions	1,83	9,125

Estimated investment for metro network in India from financial year 2020 to 2025, by area of infrastructure, in USD billions		Estimated passenger traffic in 2030, in billions
Metro rail construction	20	7.3 (triple than in 2020)
Rolling stock	4	
Signals and telecommunications	2	

Source: World Bank; Climate Trends; INE; The Times of India

The world's most traffic jam prone cities as of 2019		
1	**Bangalore**	71%
2	Manila	71%
3	Bogota	68%
4	**Mumbai**	65%
5	**Pune**	59%

Source: TomTom

Perceived barriers about using public transportation across India in 2019, by gender		Women	Men	Total
1	Quality of infrastructure	53%	41%	47%
2	Frequency of service	48%	45%	46,5%
3	Lack of seamless travel	45%	40%	42,5%
4	Duration of commute	29%	35%	32%
5	Affordability	21%	24%	22,5%

Source: Council on Energy, Environment and Water

collaboration between Spain and India in areas such as connectivity or intermodality.

Cooperation in urban transport infrastructures has an interesting opportunity for bilateral collaboration in European initiatives. Investment by the European Investment Bank (EIB) in metro projects in India, including Bhopal, Pune, Bangalore, Lucknow or Kanpur, has amounted to euros 2.65 billion, more than half of the total EIB budget for India, of which euros 650 million have been earmarked for the future metro of Kanpur, the EIB's second largest operation outside the European Union. The initiatives proposed in the European Union project "Preparation for an EU-India Sustainable Urbanisation Partnership", within the framework of the visit of an Indian delegation of urban planning to Barcelona in 2017 and a sustainable urban planning workshop in Mumbai in 2019 –both led by **Acciona Ingeniería**– include the construction of five multimodal stations connected by an urban railway and various areas of sustainable mobility, areas in which Spain is a pioneer and its companies are world leaders. Transportation also receives the most allocations from the World Bank, which has participated in the development of the metro of Mumbai, of the Asian Development Bank, and the metros of Jaipur, Bangalore or Chennai.

The collaboration of Spanish companies in the design, construction, supplies and operation of the main urban and suburban transport lines, which has been very successful to date, still has great potential for development. Noteworthy examples are the projects to improve mobility in the metropolitan areas of Delhi, Mumbai, Bangalore or Kochi. In 2019, the Spanish company Ayesa was awarded a tender for the technical assistance of the high-speed line –Regional Rapid Transport System (RRTS)– that will run from Delhi to Meerut. The company from Seville has also participated in different urban projects in Mumbai, where it is designing four stations and its four kilometres

Visit to the Adif control center during the 1st Spain-India Forum.

of tunnels of the metro line 3, and in Delhi, such as the extension of the metro's blue line and the construction of six of its stations or the Noida-Greater Noida Corridor. Also, in Delhi, the Basque company **Alsina** participated in the construction of the Kalkaji Mandir Metro Station, in Kochi, in 2015. **LKS**, belonging to the Mondragón Group, currently LKS Krean, collaborated in the Vittyla Mobility Hub intermodal station, and in Bangalore in 2019, the company from Madrid **Ardanuy Ingeniería** was awarded a tender for the design of the energy supply, the third-rail traction and the SCADA system of the two new metro lines.

In the field of equipment and components, the Basque company **CAF** supplied in 2010 the 8 trains and 6 locomotives, including their maintenance, for the express metro connection between New Delhi and the Indira Gandhi International Airport. In 2019, **CAF Power & Automation** –the result of the merger of three companies of the CAF group, i.e. Trainelec, Traintic and DTQ4– was selected for the development and manufacturing of a prototype of the traction chain and electrical components for Train 18, a semi high-speed intercity train designed and built by the Integral Coach Factory (ICF) of Chennai, within the framework of the Make in India initiative.

In this bilateral collaboration, technology plays an essential role in guaranteeing the mobility of people, the intermodality of transport systems and environmental sustainability. In recent years, **Indra** has implemented its contactless ticketing technology and new payment solutions via mobile phone, making access more convenient and faster in the Delhi metro and its Airport Express line, as well as in the metros of Mumbai and Kolkata. In 2017, **Siemens Mobility Spain**, in collaboration with the Indian and German divisions, was awarded a tender for the installation of railway signalling of the first two lines of the Nagpur metro, including its technological solution CBTC (Communications-Based Train Control) Trainguard MT.

4.4.

Innovation and bilateral participation in the development of sustainable cities

India, with a population size that will exceed China's in the coming years within a territory that is almost three times smaller, is experiencing a significant pressure on its natural resources and its environment. Economic development is causing an unstoppable process of urbanisation in India, leading millions of people to being displaced to the large cities. Six of the ten cities with the worst air quality are in India, Delhi being the world capital with the highest environmental pollution (IQAir, 2020). India has tripled its amount of municipal solid waste in recent years, only surpassed in annual generation by China. One of the major challenges in urban India is the management of urban solid waste, as 62 million tonnes are generated annually in urban areas, almost 90% deposited in non-authorised areas (National Statistical Office, 2019a). Spanish and Indian populations share a similar perception of their main environmental problems, such as climate change, pollution or deforestation (see Illustration 33).

Both Spanish public bodies and private companies, which have implemented pioneering projects in urban sustainability during the last decades, turning their cities and companies into global benchmarks, have extensive urban experience and technical knowledge. These synergies were brought to light during the fifth edition of the 2016 Indian Leaders Programme, which focused on sustainable urban development, favouring the exchange between institutions and experts from both countries. This complementarity in sustainable urban development between the business and academic fabrics of both countries was confirmed during a meeting between the trustees of the Spain-India Council Foundation and a delegation of Indian architects and urban planners from the Urban Vision think tank in 2015.

Barcelona is one of the top references in international urban planning, and this can also be said for India. Since the mid-19th century, Barcelona has developed an urban planning model perceived as the organisation of public space in cities aimed at improving citizens' quality of life of. Barcelona is moving towards this model, firmly committing itself to recovering spaces on public roads for pedestrian use which had previously been intended for private vehicles, through projects including Superblocks –original concept by Le Corbusier, the creator of the Indian city of Chandigarh–, as well as reducing lanes in the streets of Barcelona and using them instead for non-polluting vehicles and pedestrians. Urban freight distribution represents a logistical challenge for distributors, especially in neighbourhoods with higher population density, where there are narrow streets, very small turning radiuses or a large influx of pedestrians. Barcelona has developed a sustainable freight distribution system, making the route, known as the last mile, more efficient, safe and sustainable by using electric tricycles. Another related initiative is the creation of regulated parking lots for *Urban Merchandise Distribution* (DUM), providing service on weekdays from 8 am to 8 pm to all the vehicles that need to distribute goods very close to the destination point for a limited time of 30 minutes.

Several Spanish companies have already participated in flagship projects for the urban development of Indian cities. This is the case of the Basque engineering company **LKS**, currently LKS Krean, which designed and implemented the Master plan for the complete renovation of the city of Panaji, in Goa, to improve urban sustainability and the quality of life of its inhabitants. Following the guidelines identified in the master plan that

LKS developed for Panaji in 2014, LKS itself developed several urban engineering projects to generate a balanced urban fabric and an integrated public infrastructure, including the reform of public spaces, bridges and footbridges, creating pedestrian areas and improving streets and playgrounds. In 2017, LKS also completed the master plan design for the new Mazagon Dock development in Mumbai. Two years before, in 2015, the proposal of the consortium formed by the Indian CP Kukreja Arquitectos and the Basque **IDOM** was elected for the conceptual design and the basic project of the East Delhi Hub, a project for a vertical, sustainable and smart city in Delhi.

In the field of urban construction, the proposal of the Basque company **IDOM** was also awarded in 2017 the international tender convened by the Delhi-Mumbai Industrial Corridor Development Corporation (DMICDC), whose CEO inaugurated the first Spain-India Forum, for the India International Convention & Expo Centre (IICC), which will become the largest exhibition ground

ILLUSTRATION 33 / **Environmental indicators of Spain and India**

Countries with greatest solid waste generation in the world in 2018		
1	China	15.5%
2	**India**	**12%**
3	United States	11.6%
4	Brazil	3.9%
5	Indonesia	3.3%

Source: Verisk Maplecroft

Countries with greatest e-waste generation in 2019, in thousand tonnes		
1	China	10,129
2	United States	6,918
3	**India**	**3,230**
4	Japan	2,569
5	Brazil	2,143

Source: United Nations University

Waste generation and collection in Spain and India	Spain	India
Urban waste collected in Spain (2017) and India (financial year 2018-2019), in million tonnes	22.51	54.6*

*Source: Spanish National Statistics Institute (INE); MOSPI. *Calculated by the authors with data from the National Statistical Office (MOSPI). Official figure: 152,077 tonnes/day and 149,749 tonnes/day*

Most concerning environmental issues according to citizens across India in 2019		
1	Air pollution	50%
2	Climate change or global warming	43%
3	Overpopulation	39%
4	Water pollution	28%
5	Deforestation	25%
6	Poor quality of drinking water	21%
7	Waste management	20%
8	Depletion of natural resources	17%
9	Emissions	10%
10	Future energy sources and their supply	10%

Source: IPSOS

Most concerning environmental issues according to citizens across Spain in 2019		
1	Climate change or global warming	51%
2	Air pollution	41%
3	Waste management	35%
4	Deforestation	29%
5	Emissions	24%
6	Depletion of natural resources	23%
7	Future energy sources and their supply	17%
8	Excessive packaging of consumer goods	17%
9	Water pollution	12%
10	Nature conservation	9%

Source: IPSOS

in India and South Asia. In 2018, Prime Minister Modi himself placed the first stone for the IICC. The innovative solutions of **ULMA Construction**, from the Mondragón group, have been essential to guaranteeing the safety of workers in the construction of residential towers in Mumbai or Hyderabad.

In the field of waste management, several Indian delegations, also within the framework of the 1st Spain-India Forum and the 5th Indian Leaders Programme organised by the Spain-India Council Foundation, have visited the Valdemingómez Technology Park (PTV), which comprises practically all the urban waste treatment facilities in the city of Madrid and is made up of eight facilities: three waste treatment and classification centres; two biomethanisation plants, in which the organic fraction of urban waste is treated in digesters, obtaining biogas; a biogas treatment plant, to clean, purify and transform it into biomethane; two energy recovery plants that produce electricity; and a visitor centre for environmental education. The PTV, which has also launched several odour control systems to learn at all moments what odours are generated and how they affect the environment, has played an essential role in treating potentially-infectious waste in the city of Madrid as a consequence of the COVID-19 pandemic, which have been treated in its incineration plant to guarantee their disposal. These opportunities for bilateral collaboration have been implemented for the first time with the contract signed in 2019 between the Greater Chennai Corporation (GMC) and the Spanish company **Urbaser**, for the collection and transport of solid waste and urban cleaning in seven districts of the city.

4.5.

The dimension of renewable energies to address bilateral energy challenges

India is pursuing a major energy renovation to limit its high dependence on external markets. By 2040, and taking the current trend as a reference, energy demand could be doubled, due to the growing vehicle fleet, among other reasons, and electricity demand could triple, due to the increase in the ownership of electrical appliances and cooling needs. India is the world's second largest importer of coal, third of oil and fourth of natural gas (see Illustration 34). However, India has taken significant steps to improve its energy efficiency, avoiding an additional 15% growth in annual energy demand and 300 million tonnes of CO2 emissions over the 2000-18 period. By raising the bar on its ambition for energy efficiency, India could save around USD 190 billion a year in energy imports by 2040 (International Energy Agency, 2020).

India's per capita emissions currently amounts to 1.6 tonnes of CO2, well below the world average of 4.4 tonnes, while its share in total global CO2 emissions accounts for 6.4%. Renewable energies represent 36% of the generation park in India, hydroelectric ranking first, with 14% of the installed capacity in the country, wind ranking third, with 38 GW installed and 10% of all installed capacity, and solar ranking fourth, with 34 GW and 9.3% (Central Electricity Authority, 2018) (See Illustration 35). Thanks to energy efficiency initiatives and its commitment to renewable energies, India has made major progress in meeting the United Nations Sustainable Development Goals, especially Goal No. 7 –access to energy.

India is the world's fourth-largest onshore wind market in number of facilities, with 37.5 GW of wind capacity in 2019, driven by the growing

ILLUSTRATION 34 / **Energy indicators of India**

Global oil consumption in 2019

	Country	Consumption, in thousands of barrels/day	Share
1	United States	19,400	19.7%
2	China	14,056	14.3%
3	**India**	**5,271**	**5.4%**
4	Japan	3,812	3.9%
5	Saudi Arabia	3,788	3.9%

Global oil imports in 2019

	Country	Imports, in thousands of barrels/day	Share
1	China	11,825	16.7%
2	United States	9,094	12.8%
3	**India**	**5,379**	**7.6%**
4	Japan	3,779	5.3%
5	Rest of the world	40,847	57.6%

Global coal consumption in 2019

	Country	Consumption, in exajoules	Share
1	China	81.7	51.7%
2	**India**	**18.6**	**11.8%**
3	United States	11.3	7.2%
4	Japan	4.9	3.1%
5	South Africa	3.8	2.4%

Global coal imports in 2019

	Country	Imports, in exajoules	Share
1	China	6.4	18.1%
2	**India**	**5.7**	**16.1%**
3	Japan	4.9	13.9%
4	South Korea	3.7	10.6%
5	Rest of the world	14.6	41.3%

Global natural gas consumption in 2019

	Country	Consumption, in billion cubic metres	Share
1	United States	846.6	21.5%
2	Russia	444.3	11.3%
3	China	307.3	7.8%
4	Iran	223.6	5.7%
5	Canada	120.3	3.1%
13	**India**	**59.7**	**1.5%**

Source: BP

Global imports of liquefied natural gas in 2019

	Country	Imports, in billion cubic metres	Share
1	Japan	105.5	21.7%
2	China	84.8	17.5%
3	South Korea	55.6	11.5%
4	**India**	**32.9**	**6.8%**
5	Rest of the world	206.3	42.5%

demand of energy and the ambition of its government plans. The Government of India is targeting 175 GW of renewable energy capacity by 2022, of which 60 GW will come from wind power, and 450 GW by 2030, of which 140 GW will come from wind power generation (Global Wind Energy Council, 2020). In the field of solar energy, the country's installed capacity reached 28.18 GW on 31st March, 2019, compared to the 21.65 GW it had on the same day of the previous year (National Statistical Office, 2020b). In this regard, a recent analysis of the International Energy Agency (IEA) shows that in 2018, India's investment in photovoltaic solar energy was higher than in all fossil fuel sources of electric generation combined.

ILLUSTRATION 35 / **Renewable indicators of India and Spain**

All renewable energies		
Capacity, in MW	2018	2019
India	118,079	128,233
Spain	48,257	54,592
Production, in GWh	2017	2018
India	209,072	235,722
Spain	87,924	103,885

Wind energy		
Capacity, in MW	2018	2019
India	35,288	37,505
Spain	23,405	25,553
Production, in GWh	2017	2018
India	47,670	55,009
Spain	49,127	50,896

Photovoltaic solar energy		
Capacity, in MW	2018	2019
India	27,127	34,831
Spain	4,764	8,761
Production, in GWh	2017	2018
India	17,768	30,707
Spain	8,514	7,877

Hydroelectric energy		
Capacity, in MW	2018	2019
India	50,082	50,225
Spain	20,080	20,118
Production, in GWh	2017	2018
India	131,351	136,599
Spain	21,070	36,803

Bioenergy		
Capacity, in MW	2018	2019
India	10,140	10,228
Spain	1,037	1,189
Production, in GWh	2017	2018
India	16,872	17,997
Spain	6,078	5,911

Installed capacity of wind energy in the world in 2019		
	Country	MW
1	China	237,029
2	United States	105,433
3	Germany	61,357
4	**India**	**37,529**
5	**Spain**	**25,808**

New installations of wind energy in the world in 2019			
	Country	MW	Share
1	China	26,155	43.3%
2	United States	9,143	15.1%
3	United Kingdom	2,392	4%
4	**India**	**2,377**	**3.9%**
5	**Spain**	**2,189**	**3.8%**

Global exports of wind technology in 2018			
	Country	Net exports, in billion euros	Share
1	Germany	1,051	39.6%
2	Denmark	1,48	33.4%
3	**Spain**	**791**	**19.7%**
4	China	316*	7.5%*
5	Portugal	160	3.6%
7	**India**	**23**	**0.61%**

** 2017*

Source: EurObserv'ER Consortium; Global Wind Energy Council (GWEC); International Renewable Energy Agency (IRENA)

The Spanish commitment to renewable energies and the fight against climate change can be seen in the project for the Integrated National Energy and Climate Plan (PNIEC) for 2021-2030, targeting a 23% reduction in greenhouse gas emissions compared to 1990; up to 42% of renewable sources on energy end-use; a 39.5% improvement in energy efficiency and 74% of renewable energy sources of the total electricity generation (Ministry for the Ecological Transition and the Demographic Challenge, 2020). Sustainability is one of the cornerstones of the Government of Spain's "Recovery, Transformation and Resilience Plan" for 2021-2023, which will allocate 37% of its funds to ecological transition.

These investment policies for the renewable energy sector in both countries are revitalising bilateral contacts. Within the framework of the 2016 technical visit to India by a delegation from the Government of Navarra, the National Renewable Energy Centre of Spain (CENER) and ten companies of the sector, a collaboration agreement was signed between CENER and the National Institute of Wind Energy (NIWE) and contacts were established between companies from both industrial sectors. In 2017, the 2nd Spain-India Forum promoted by the Spain-India Council Foundation focused on renewable energies, and the Spanish Photovoltaic Union (UNEF) and the National Solar Energy Federation of India (NSEFI) signed a collaboration agreement whereby both organisations will work together to promote solar energy and defend the interests of the sector in both countries. In 2018, India was a guest country at the 4th Spanish Wind Congress.

Regarding the participation of Spanish companies in the solar energy sector in India, the company from Albacete **Immodo Solar**–in a joint venture with the Indian company Electrotherm–was the first Spanish company to build a large-scale solar plant in India, inaugurating its Gujarat plant in 2012. Other projects by Spanish companies in India include **Abengoa**, which built its first photovoltaic plant in 2017 in the state of Uttarakhand; **Fotowatio Renewable Ventures**, which inaugurated its first large-scale solar energy capacity in Andhra Pradesh in 2018; or **Solarpack**, which developed two solar plants in 2017 and 2019 with a total capacity of 156.6 MW. Within the European Union's programme Clean Energy Cooperation with India (CECI), the Spanish companies **NIXUS** and **IDOM** have participated in the technical assistance for the implementation and management of the identified solar parks.

Similarly, Spanish companies are also participating in projects of Indian public companies to develop the renewable energies sector. Examples of these include the Spanish company **Solarpack**, which was awarded a long-term electricity sales contract in 2020 as a result of the competitive process launched by the Solar Energy Corporation of India (SECI). The Spanish company **AleaSoft** collaborates with the Power Grid Corporation of India since 2020, as a provider of solar and wind energy forecasts. **Mercado Aries International**, a Spanish energy consultancy, also participated in a renewable energy project in Rajasthan, assisting the transmission company Rajasthan Rajya Vidyut Prasaran Nigam Limited (RVPN) in planning and operating the existing transmission system to adjust a significant penetration of renewable energy in the network.

The major Spanish wind energy companies present in India include **Acciona**, with four operating wind farms in the state of Karnataka and a Nordex turbine and rotor blade factory in Tamil Nadu (see Case 9). **Siemens Gamesa** has been present in India since 2009, with two rotor blade factories in Andhra Pradesh and Gujarat, a nacelles factory and an operations and maintenance centre in Tamil Nadu and a Research and Development centre in Bangalore, where it employs more than 100 engineers. The

Wind power plant in Rajasthan.

German-Spanish company is a clear example of innovation in India, as it has developed the first hybrid wind-solar commercial park and is building its most powerful wind turbine in India, specifically designed for the South Asian country, which offers a 48% increase in power generation compared to its predecessor. Of the 19 production centres belonging to the companies identified that contribute to the renewable energy value chain, 13 are located in the south of the country –10 in the Chennai industrial hub and 3 in the Coimbatore hub (see Illustration 36).

Inversely, there are several Indian companies that participate in the renewable energy value chain in Spain, such as **Enzen** or **Mahindra Susten**. The Indian multinational **Suzlon**, of the renewable energies sector, has installed 160 wind turbines in the Iberian Peninsula, the largest operation in European markets, showing that the sector offers a scenario of growth and mutual benefit for both countries. These companies illustrate that Indian companies can also participate in Spain's ecological transition.

ILLUSTRATION 36 / **Selection of Spanish companies that participate in the value chain of the development of renewable energies in India, including production plants**

	Spanish company	Production plants	Total
1	Abengoa		
2	Acciona-Nordex	Coimbatore (1)	1
3	AleaSoft		
4	Ampo	Coimbatore (1)	1
5	Ekin	Gurgaon (1)	1
6	Fluitecnik		
7	Fotowatio Renewable Ventures		
8	Frenos Iruña	Kanchipuram (1)	1
9	Glual Hidráulica	Kanchipuram (1)	1
10	Gorlan Team	Coimbatore (1)	1
11	Hine Renovables	Thiruvallur (1)	1
12	HRS Heat	Pune (1)	1
13	IDOM		
14	IED Greenpower		
15	Immodo		
16	Industrias Barga	Chennai (1)	1
17	Ingeteam	Chennai (1)	1
18	Kintech Ingeniería		
19	Laulagun Bearings	Chennai (1)	1
20	Mercado Aries International		
21	Mondragon Assembly	Delhi (1)	1
22	NIXUX		
23	Siemens Gamesa	Nellore (2), Halol (1) and Mamandur (1)	4
24	Solarpack		
25	Tubacex	Umbergaon (1)	1
26	Windar Renovables	Halol (1) and Chennai (1)	2

Source: Own elaboration based on the websites and annual reports of the companies.

IN DETAIL 11

The dragging effect of major Spanish companies in the wind sector

The presence of major companies of the wind energy sector in India, such as Acciona or Siemens Gamesa, has a pull factor for other Spanish companies. These component or service companies, which provide these large companies in Spain and other countries, decide to establish themselves in India to continue supplying them in the local market. Thanks to their internationalisation in India, they can access new clients and business development opportunities in an expanding market.

The Spanish component companies that have a factory in Tamil Nadu to supply these companies in the local market include **Frenos Iruña** –brake systems– **Ingeteam** –wind converters–, **Hine** –hydraulic solutions and cooling systems–, **Laulagun Bearings** –large bearings–, or **Industrias Barga** and **Glual** –components for wind turbines.

Other Spanish companies that participate in the wind sector value chain in India include **Abengoa**, which was selected by Gamesa in 2017 to supply and manufacture steel structures for two photovoltaic projects in India; **Windar Renovables**, whose plant in Gujarat won the 2016 wind tower manufacturer of the year award at the Indian Wind Energy Forum (IWEF) or **Fluitecnik**, which recently signed a partnership with the largest manufacturer of automotive components in India, Wheels India (belonging to the TVS group), which will allow both companies to create synergies in the wind sector, promote engineering projects and develop alliances with local suppliers.

CASE 9

Acciona, technology partner for the 21st century's sustainable India

ACCIONA, a global company with a business model built around sustainability, designs technological solutions for renewable energy, resilient infrastructures, water management and treatment, and urban development. With **experience in more than 65 countries of the five continents**, ACCIONA generates almost 23,000 GWh of clean energy, supplying the equivalent of the demand of approximately seven million households, and preventing the emission into the atmosphere of almost 15 million tonnes of CO_2 a year. In the field of infrastructures, throughout its history it has designed and executed more than 3,000 kilometres of railways, of which more than 1,700 km are high-speed, and in the last ten years it has built more than 5,300 kilometres of roads. ACCIONA treats 1,030 Hm3 of water annually, of which 50.4% belongs to water-stressed countries, and eliminates 850,000 tonnes of waste, establishing itself as a benchmark in sustainability.

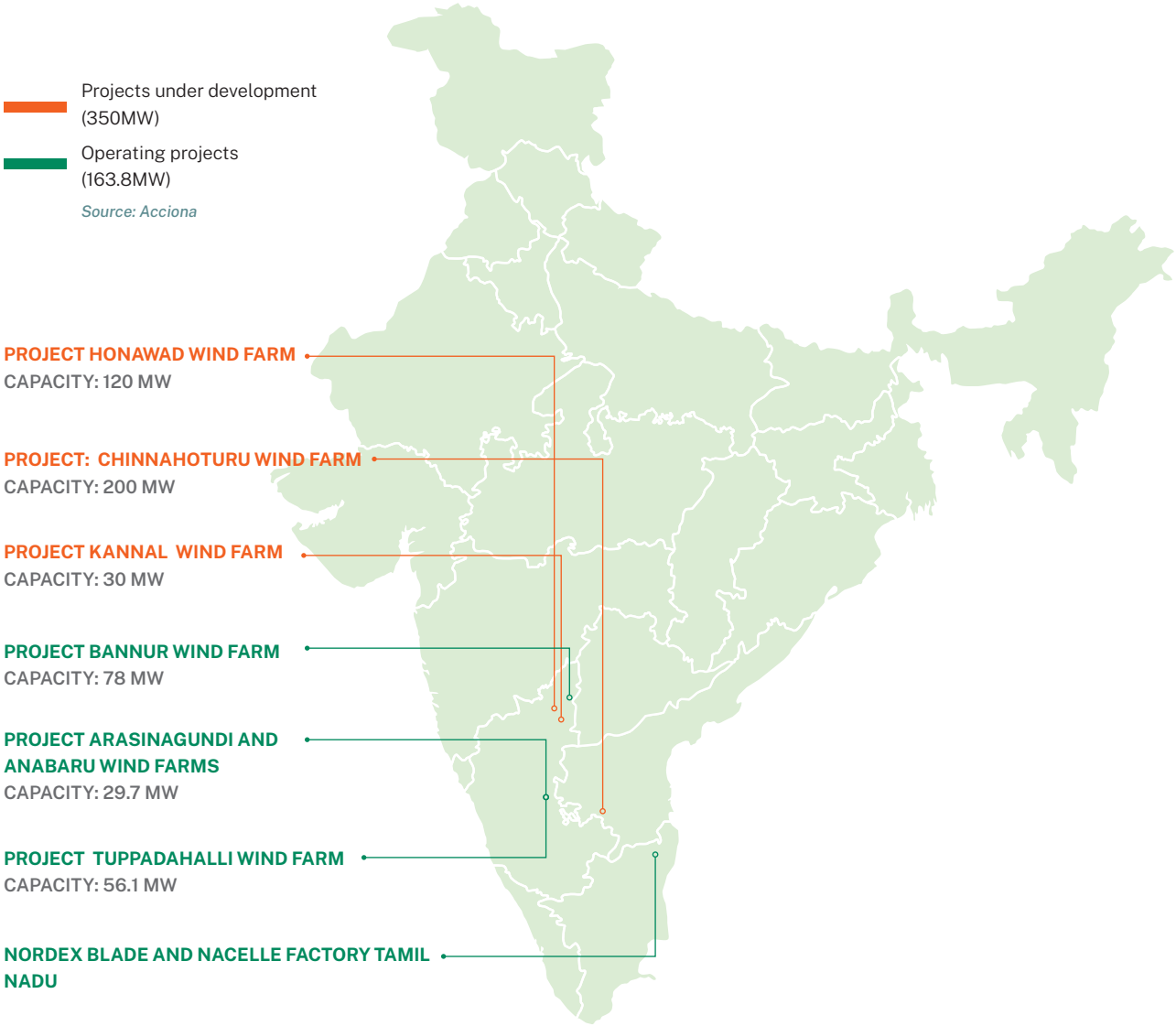
ACCIONA **initiated its activities in India in March, 2006**, by entering the energy division. It became the first Spanish company to install and operate a wind farm in India. ACCIONA currently has **four operating wind farms** in the state of Karnataka, amounting to 163.8 MW, all of which are 100% owned by the company. The wind farms of Anabaru (16.50 MW), installed in 2007, and Arasinagundi (13.20 MW), in 2008, close to one another and both located in the region of Davangere, were the first wind farms built by a Spanish developer in the country. In 2011, ACCIONA connected the 56.1 MW Tupadahalli wind farm, also located in Karnataka, to the grid. All three have been registered as Clean Development Mechanism of the Kyoto Protocol. The company also put into service the wind park of Bannur, of 78 MW, in 2017, becoming the largest wind project of ACCIONA to date in India.

ACCIONA is currently **building three more wind farms** that will triple the current capacity, two in Karnataka –in Honawad, with a capacity of 120 MW, and in Kannal, with a capacity of 30 MW–, and one in Andhra Pradesh –in Chinnahoturu, with 200 MW. The NORDEX Group, owned by Acciona Windpower, has a **turbine and rotor blade factory in Tamil Nadu** (see Illustration 37). NORDEX will supply, erect and commission 100 turbines, with an installed capacity of 3 MW each, in a wind project in Mulanur, Tamil Nadu.

In other fields such as **urban development or water resources**, ACCIONA also has the experience and technology to become a technology partner for sustainable India. ACCIONA started its water business line in 2011, establishing its operations base in New Delhi. In 2019, ACCIONA engineering participated, in collaboration with Mumbai First –a public-private platform to promote the development of Mumbai– in the project "Preparation for an EU-India Sustainable Urbanisation Partnership", an initiative that has strengthened the cooperation ties between the European Union and India on sustainable urban development and smart cities.

ACCIONA, which in 2019 was included for the second consecutive year in the "Global 100 Most Sustainable Corporations" ranking, and which has ranked first in the "New Energy Top 100 Green Utilities" ranking for four consecutive years, is also a **company committed to India**. It was one of the first private companies to establish the National Covid-19 Funds of India, it has participated in sustainable urban planning activities and has trained students from schools in India on the importance of sustainable development.

ILLUSTRATION 37 / **Presence of Acciona in India in the wind energy sector**



4.6.

Common challenges in the water cycle and joint collaboration on water efficiency

Spain and India share challenges when it comes to the water stress they have historically suffered. Three of the cities with the greatest water stress in the world are found in India –Chennai, Hyderabad and Kolkata. Parallel to the economic and demographic growth of India, the demand for water in the country is increasing annually in sectors like agriculture, industry and especially energy (see Illustration 38). At a European level, Spain is one of the countries with the highest water stress, as the Mediterranean basin is one of the European regions with the highest risk due to climate change. These common challenges, which have forced both countries to innovate

Spain and India maintain great institutional cooperation in the management of the water cycle.

and promote technological solutions in water efficiency, represent new opportunities for a public-private bilateral alliance.

The growing institutional cooperation between Spain and India on water cycle management evidences the strategic importance that water efficiency has for both countries. The Ministry for the Ecological Transition of Spain received a delegation from the Ministry of Water Resources of India in February, 2019, to familiarise themselves with the best practices of the Spanish management model. The Indian delegation held meetings with the authorities of the Júcar and Segura river basins, with the Centre for Hydrographic Studies in Madrid and with the Research Institute of Water and Environmental Engineering (IIAMA) in Valencia. The 2018 edition of the Indian Leaders Programme organised by the Spain-India Council Foundation was dedicated to the water management sector, in which Indian experts in the sector participated. These dialogues and exchanges show the complementarity of the Spanish experience and technology with the Indian water efficiency targets.

Several Spanish companies collaborate in various Indian water projects at the level of European and multilateral financing. **Eptisa** is participating in the second phase of the National Hydrological Project of India (2017/2018 - 2023/2024), to which the World Bank has contributed a USD 175 million loan, in addition to technical assistance and management consulting. The company **Cadagua**, a subsidiary of Ferrovial's water treatment infrastructures, inaugurated its drinking water treatment plant (commonly known as ETAPs) in 2013 in Hogenakkal, Tamil Nadu, a project financed by the Japan Bank for International Cooperation (BJCI). Spanish organisations have had a leading participation within the framework of the calls for tenders with European funding for water technology projects with India, in which Spain ranked the first EU Member State with the most number of organisations participating in selected projects.

Regarding the participation of Spanish companies in programmes of Indian public bodies, **Abengoa** has developed desalination and water treatment projects, the main one being the Chennai desalination plant –it was the largest

reverse osmosis plant in the country when it was built, operating since 2010– and is currently participating in the design, construction, operation and maintenance for 10 years of two sewage treatment plants and their respective sanitation networks for the state-owned Madhya Pradesh Urban Development Company (MPUDC). The Basque engineering company **LKS**, now LKS KREAN, developed the comprehensive master plan for the Cooum River in Chennai, with the aim to reduce pollution, maintain a minimum ecological flow, protect the river from the

IN DETAIL 12

Spain's participation in the Yamuna river regeneration project.

In 2017, an agreement was signed between the Embassy of Spain in India and the University of Virginia (US) on the project to recover the Yamuna River. This project, for which the Embassy of Spain in India is collaborating with the Delhi Jal Board –in charge of water management in the capital– and the University of Virginia (US), is a **multidisciplinary proposal for the comprehensive regeneration of the urban environment of Delhi**, which covers different intervention areas, including water management, infrastructure, urban design or environment. The book "Yamuna River Project: New Delhi Urban Ecology" has recently been awarded one of the DAM Architectural Book Award 2018, awarded by the Deutsches Architeckturmuseum (DAM), which grants recognition to the ten best books on architecture of the year.

Meeting on the Yamuna river regeneration project held at Casa Asia in 2018.

The authors and directors of the project are the Spanish architect Iñaki Alday and the Indian architect Pankaj Vir Gupta, who presented the initiative in Spain backed by the Spain-India Council Foundation in 2018. Spain could participate in its implementation in Delhi or in any other of the many cities in India that suffer from a similar problem, both at an institutional and business level, contributing its experience in water management and sustainable urban development.

Through a series of exhibitions and symposia, the Yamuna River Project has rallied the direct support of the people of New Delhi. It has also attracted **government and institutional interest**. The Ministry of Water Resources is considering creating a single agency responsible for all the issues related to the river and its urban impact, and the Delhi government has begun to promote measures aimed at reversing the situation of the Yamuna River. Other regional institutions have also been interested in the project, including the State of Rajasthan, for the transformation of the city of Tonk. The project could also be considered for multilateral financing, for example, from the European Investment Bank.

ILLUSTRATION 38 / **Water indicators of India**

Countries with highest risk of drought in the world in 2019, from 0 to 1		
1	Moldavia	0.82
2	Ukraine	0.81
3	Bangladesh	0.79
4	**India**	**0.76**
5	Serbia	0.75

Source: World Resources Institute; World Wildlife Fund

Cities in the world with highest water stress in 2018, from 0 to 5		
1	**Chennai**	**3.48**
2	Istambul	3.24
3	Tehran	3.07
4	**Hyderabad**	**3.03**
5	**Kolkata**	**2.86**

Source: World Resources Institute; World Wildlife Fund

Water demand in India

Application	Water demand in 2010, in billion cubic metres	Share
Irrigation	688	84.6%
Drinking water	56	6.9%
Industry	12	1.4%
Energy	5	0.6%
Others	52	6.3%

Application	Water demand in 2025, in billion cubic metres	Share
Irrigation	910	83.2%
Drinking water	73	6.6%
Industry	23	2.1%
Energy	15	1.3%
Others	72	6.5%

Application	Water demand in 2050, in billion cubic metres	Share
Irrigation	1,072	74%
Energy	130	8.9%
Drinking water	102	7%
Industry	63	4.3%
Others	80	5.5%

Source: ASSOCHAM-Ernst&Young

activities being carried out in the banks, improve its hydraulic capacity, develop a new river front and integrate new activities along it. In addition, it also contributed its consultancy experience to the comprehensive project for the ecological restoration of the Adyar River in the same locality. In 2018, **Alsina** participated in the construction of a set of dams on the Godavari River, in Andhra Pradesh. Spain's participation in the regeneration of polluted Indian rivers has found new boundaries for collaboration in the Yamuna River project (see In Detail 11).

Educational bodies, foundations and Spanish NGOs are also participating in water projects in India, such as the Polytechnic University of Valencia (UPV), with the research project ADSIDEO About Water, in Ahmedabad, for the design of learning and communication resources on the value and good use of water for children between 6 and 12; the We Are Water Foundation, with 11 projects completed focusing on water throughout India and two in progress; or the Vicente Ferrer Foundation, which is an ambassador of the Indian Government's programme Swachh Bharat –Clean India– in the districts of Anantapur and Kurnool.

4.7.

Technological cooperation to create 4.0 Smart Cities

The Government of India launched the Smart City Mission project in 2015, an ambitious innovation project to turn a group of Indian cities into smart cities. During five selection rounds, the Ministry of Urban Development has chosen 99 Indian cities for the development of the project, to which India has undertaken to provide a financial support of USD 74.8 million per city. Additionally, the Atal Mission for Rejuvenation of Urban Transformation (AMRUT) pursues the urban renewal of 500 Indian cities (MoUD, 2019).

In Spain, the National Plan for Smart Cities, with European funding and a budget of 188 million euros, seeks to improve the effectiveness and efficiency of local organisations in the provision of public services through ICT and to make progress in the system of Smart City and Tourist Destination (Red.es, 2018). These transformation projects for 4.0 cities based on the use of information technologies result in a better quality of life for citizens, greater interaction with the environment and an increase in the saving of energy and environmental resources.

Spanish companies, whose technical and innovative urban experience has participated in the development of smart cities in several countries, have also contributed to the projects of the Smart City Mission of India. In 2015, **Indra** signed an MoU with the Confederation of Indian Industry (CII) to promote the joint design of smart city models in the Asian country using the Sofia2 platform, a European R&D project that facilitates home automation and the provision of intelligent services through mobile devices. Additionally, **LKS** has participated in the design of the master plan for the Solapur smart city project, while **Eptisa** was selected as Project Manager Consultant for technical advice in the execution and implementation of smart city projects in five of the cities participating in the Smart City Mission –Jaipur, Udaipur, Indore, Patna and Kakinada. Three of these cities have been included in the Top10 of the ranking published by the Indian Government to choose the "Best performing Smart Cities'' in 2018 and 2019. Intelligent management of mobility, solar energy generation, smart roads or improvements in the water networks are some of the projects that have been implemented. Noteworthy examples in the case of the city of Jaipur include the transformation of the Gandhi Nagar train station, providing it with intelligent parking systems; the construction of an underground car park in Ramgank Bazar or the installation of a solar system on the roof of the University of Rajasthan.

There are several joint collaborations that show the complementarities of bilateral partnerships in smart cities. In terms of organisation, the Smart City World Congress of Barcelona is the main international meeting point for smart cities. This organisational experience of Barcelona was essential for the development of the Smart City Expo India 2018 in Jaipur, organised by the Jaipur Development Authority with the support of the trade fair organisation Fira Barcelona, with the aim of showing the latest trends in the development of smart cities worldwide. Joint projects in the field of smart cities include the partnership between the Indian company **Enzen** and the Spanish company **Ride-On** in 2019, to collaborate in the deployment of micro-mobility projects around the world.

Ideas and proposals for the revitalisation of relationships in urban development and sustainability

The common challenges in the sustainable urban development of the Indian and Spanish cities create important opportunities for bilateral cooperation. The alliance between Valladolid and Ahmedabad is an example of the multiplying effect of Indo-Spanish municipal cooperation in the fields of culture, business, technology or universities. However, the cities of both countries lack solid exchange networks, including relationships between large cities, even though they are the gateway for numerous delegations from both countries to promote collaboration and mutual knowledge. The institutionalisation of our relationships, both at a municipal level, through bilateral agreements and platforms, and at a state level, signing framework agreements in strategic sectors in the field of sustainability, is one of the pillars that are yet to be created to generate a suitable environment for the revitalisation of our relationships regarding urban development and sustainability.

In the private sphere, the wind energy sector is an example of the success of the participation of Spanish companies in the sustainable development of India, as well as the dragging effect that the establishment in India of large Spanish companies of the sustainability sector has for their Spanish SMEs providers. This same model can be replicated in other sectors in which Spain is a world leader, including urban solid waste treatment or the water cycle. The technical and technological experience of Spanish companies can be a key tool, yet to be exploited, in the transformation of Indian cities into 4.0 cities.

The measures compiled in this joint reflection process that could further promote cooperation in urban development and sustainability include:

1. There is a long way to go to move our bilateral relations further with new agreements in the area of urban development and sustainability. Both governments have already shown their interest in signing **MoUs on sustainable urban development and water resources. It would also be desirable to reactivate the framework agreement on renewable energies** of 2017, which, the same as its predecessor in 2009, has not had sufficient follow-up and implementation. In addition to a correct identification of counterparts, including the participation of several ministries when the competences do not fall under the scope of a single ministry, and the inclusion of two cross-cutting factors of innovation and interconnection between the business fabrics, to promote private exchanges and development of joint projects, it would also be desirable to grant the bilateral embassies an active role in their monitoring. This would avoid repeating implementation problems of certain MoUs, such as the one on renewable energies.

2. It would be desirable to **create exchange networks between cities of both countries**, using existing platforms such as a specific edition at an urban level of the Spain-India Forum promoted by the Spain-India Council Foundation, to put the different city councils and municipal corporations of both countries in contact, generating mutual knowledge and joint identification of opportunities.

3. As the cities of Murcia and Solapur have shown, there are opportunities for collaboration, such as the European programme on International Urban Cooperation (IUC) in Asia, to create **joint programmes between cities in India and Spain that promote an exchange of proposals, ideas and solutions in urban areas within cooperation initiatives of the**

Inauguration of the 2nd Spain-India Forum held by the former Minister of Foreign Affairs of Spain, Alfonso Dastis, in 2017.

European Union with India. Participating in these European programmes, just like the project between Valladolid and Ahmedabad "Cultural Heritage and Management Venture Lab in Ahmedabad", financed by Europeaid, is essential to promote joint technical cooperation. The development of these experiences of municipal cooperation could lead to the signing of an official twinning between the cities that would promote a permanent and holistic partnership that would benefit the fabrics of their civil societies.

4. The main Indian delegations mainly enter Spain through Madrid and Barcelona and, inversely, through Delhi and Mumbai. Madrid, Barcelona, Delhi and Mumbai are the main gateways and showcases for bilateral knowledge at a municipal level. The **institutionalisation of the central points of municipal cooperation between Madrid-Barcelona-Delhi-Mumbai** would favour a multiplying effect in the relations between Spain and India. It would be appropriate to support the creation of bilateral sectoral platforms in both cities, also on the sidelines of the main fairs and congresses.

5. The COVID-19 pandemic represents an opportunity to rethink urban strategies through greater public-private collaboration that increases the cities' resilience and ability to recover. **The creation of permanent spaces for sectoral bilateral dialogue**, in areas with an impact on hygiene and health, such as waste treatment or the water cycle, could generate a continuous exchange from which both countries would benefit.

6. The complementarity of the Spanish technical expertise and technological

innovation in the projects for urban development in India offers important opportunities for bilateral cooperation. However, the presence of companies in this sector is still very limited, despite the vast opportunities. It would be desirable to **promote the participation of companies in urban development and sustainability projects with EU or multilateral funding**, including the personalised dissemination of the funded projects among companies of the sector, the organisation of technical visits to promote raising awareness of Spanish projects and hybrid matchmaking initiatives with local partners.

7. The water stress that certain areas of Spain and India suffer leads to common challenges and opportunities for bilateral cooperation. The **promotion of a corridor for the exchange of water efficiency solutions throughout the water cycle** can help build a collaboration network at an institutional, business, technological, university and civil society level, with a multiplying effect.

8. The concentration of companies in the wind energy sector around the city of Chennai, in Tamil Nadu, generates important synergies and complementarities. It would be desirable to **concentrate a series of initiatives for awareness-raising, promotion and exchange on wind energy in the city of Chennai** to support the development of opportunities for Spanish companies in India and facilitate the internationalisation of both the large Spanish companies that have not yet established in India and of their SMEs providers.

9. The sustainability problems that Indian and Spanish cities share, including pollution, traffic or waste generation, require technological and innovative solutions. An example would be the promotion of **joint technological projects in the field of sustainable urban innovation**, including the creation of Indo-Spanish startups, taking into account the investment within the Government of Spain's "Recovery, Transformation and Resilience Plan" for 2021-2023.

10. Spanish participation in large Indian smart city projects is well below its potential, considering that Spanish technology has played a very relevant role in the development of smart cities around the world. The creation of **bilateral programmes in the development of smart cities**, following the CITIIS (City Investments to Innovate, Integrate and Sustain) model promoted by France, in collaboration with the National Institute of Urban Affairs (NIUA) of India and with the support of the European Union, would facilitate joint innovation and the incorporation of Spanish technology in the development of Indian smart cities.

* The proposals and ideas contained in this document do not necessarily reflect the position of the Spain-India Council Foundation, nor that of its trustees, nor that of the Indo-Spanish Chamber of Commerce, nor that of any of the entities or individuals that have contributed in this exercise.

Sources

We have collected the visions and anonymous considerations of 200 people and institutions interested in our bilateral relations through surveys and online forms, as well as from 80 bilateral stakeholders through customised virtual interviews.

Abengoa. Information obtained in: http://www.abengoa.com/web/es/negocio/agua/desalacion/

Acciona. Information provided by the company and obtained in: https://www.acciona.com/es/proyectos/asia/

Alsina. Information obtained in: https://www.alsina.com/alsina-en-el-mundo/india/

Ardanuy Ingeniería. Information obtained in: http://www.ardanuy.com/es

Ayesa. Information obtained in: https://www.ayesa.com/es/donde-estamos/india

CAF. New Delhi-Airport Metro. Information obtained in: https://www.caf.net/en/productos-servicios/soluciones-integrales/casos-estudio/metro-nueva-delhi.php

Casa de la India. Information provided by the organisation and obtained in its annual reports of 2003-2018. Available in: http://www.casadelaindia.org/

Central Intelligence Agency. "South Asia: India, People and Society". Information obtained in: https://www.cia.gov/library/publications/the-world-factbook/geos/in.html

City Council of Barcelona. Information provided by the organisation.

Climate Trends. "COVID-19 response". Available in: https://climatetrends.in/resources/

Immodo Fotovoltaica. Information obtained in: https://www.immodo.es/es/3-Proyectos/9-SOLAR-PARK-GUJARAT-INDIA.htm

India Census 2011. Available in: https://www.censusindia.gov.in/2011-Common/CensusData2011.html

Indra. "Sistema de ticketing para la línea de metro del aeropuerto de Delhi". Information obtained in: https://www.indracompany.com/es/ticketing-linea-metro-aeropuerto-delhi

Industrias Barga. Information obtained in: http://www.ibarga.com/

INE. "Estadística de transporte de viajeros, transporte urbano: metro y autobús en ciudades que dispongan de metro". Information obtained in: https://www.ine.es/jaxiT3/Tabla.htm?t=20193

INE. "Estadísticas sobre generación de residuos". Available in: https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=estadistica_C&cid=1254736176841&menu=ultiDatos&idp=1254735976612

IQAir. Information obtained in: https://www.iqair.com/newsroom/air-pollution-far-deadlier-coronavirus-new-data-ranks-health-threat-cities-worst-best

Laulagun Bearings. Information obtained in: http://www.laulagun.com/es/

LKS India. Information obtained in: http://www.india.lks-global.com/GS/IN/projects.aspx

Mercado Aries International. "Preparing the Rajasthan Renewable Energy Transmission in India". Available in: https://www.mercadosaries.com/project/preparing-the-rajasthan-renewable-energy-transmission-in-india/

Suzlon. Information obtained in: https://www.suzlon.com/in-en/suzlon-worldwide/europe

Technological Park of Valdemingómez. Information provided by the company.

The Yamuna River Project. Information obtained in: http://www.yamunariverproject.org/

TomTom Traffic Index. "Traffic congestion ranking 2019". Available in: https://www.tomtom.com/en_gb/traffic-index/ranking/

Ulma Construction. Information obtained in: https://www.ulmaconstruction.com/en/ulma/locations/asia-oceania/india

Valladolid Film Office. Available in: https://valladolidcityoffilm.com/vafo/

World Bank.

- Urban population. Available in: https://datos.bancomundial.org/indicador/SP.URB.TOTL
- Urban population in Spain and India (% of the total). Available in: https://datos.bancomundial.org/indicador/SP.URB.TOTL.IN.ZS

World Resources Institute. "Water Risk Indicator: Country Rankings". Available in: https://www.wri.org/applications/aqueduct/country-rankings/?indicator=drr

World Wildlife Fund Water Risk. Available in: https://waterriskfilter.panda.org/

Bibliography

Abengoa. "Abengoa completes its first photovoltaic plant in India". April, 2017.

AleaSoft. "AleaSoft colabora en el desarrollo de las energías renovables solar y eólica en la India". April, 2020.

Ahmedabad Mirror. "City's got a Spanish sister". July, 2017.

ASSOCHAM-Ernst&Young.

- "The Big "W" impact: Effective Urban Waste Management Solutions in India". January, 2019.
- "Effective water management: integrating innovation and technology". June, 2019

BP. "Statistical Review of World Energy 2020". 2020.

Business Insider. "India needs over 600.000 buses for 25 million commuters daily to follow social distancing norms, according to a study". June, 2020.

CAF Power & Automation. "Desarrollamos un prototipo para el Train 18, India". June, 2019.

Casa de la India. "En 2020 se fortalecerán los vínculos entre Ahmedabad y Valladolid en materia de turismo, relaciones empresariales e innovación en servicios urbanos".

Central Electricity Authority, Ministry of Power, Government of India. "National Electricity Plan". January, 2018.

Cluster Energía, Basque Energy Cluster. "Gamesa, Glual e Hine consolidan su gran momento en India". February, 2017.

Council on Energy, Environment and Water. "How urban India moves: sustainable mobility and citizen preferences". October, 2019.

Enzen. "Enzen Spain and Ride-On to establish global leadership in urban micro-mobility market". August, 2019.

Eptisa.

"Eptisa llevará a cabo el Proyecto Nacional de Hidrología en India". October, 2017.

"La ingeniería española Eptisa, clave en los proyectos de Smart Cities en India". January, 2018.

Europa Press.

"Abengoa suministrará a Gamesa estructuras para un proyecto fotovoltaico en India". February, 2017.

"Valladolid y Ahmedabad, primeras ciudades española e india hermanadas". July, 2017.

"La Comisión Europea elige a Murcia como representante europeo en Asia para exportar su Modelo de Ciudad a la India". July, 2018.

"Cáceres inicia los trámites para hermanarse con la ciudad india de Jaipur". September, 2018.

"FRV inaugura el proyecto de Andhra Pradesh, su primera instalación solar en India". October, 2018.

EurObserv'ER Consortium. "The state of renewable energies in Europe". 2019.

European Investment Bank. "India: Green, safe and affordable public transport for Kanpur as EIB invests €650 million into city metro rail". August, 2020.

Ferrovial. "Cadagua inaugura la planta de tratamiento de agua de Hogenakkal en India". June, 2013.

Fluitecnik. "Fluitecnik se alía con un gigante de la automoción en India". September, 2019.

Frenos Iruña. "Frenos Iruña compra una fábrica proveedora de caucho en Lérida". February, 2020.

Global Wind Energy Council (GWEC). "Global Wind Report 2019". 2020.

GMV. "GMV en la gestión del transporte público en la India". June, 2012.

IBF International Consulting, EQO-NIXUX, IDOM. "Stanadard Operational Procedures for Solar Plants". 2019.

IDOM.

"The new vertical district in Delhi". December, 2016.

"Se coloca la primera piedra del India International Convention & Expo Centre". October, 2018.

International Energy Agency (IEA). "India 2020: Energy Policy Review". January, 2020.

International Renewable Energy Agency (IRENA). "Renewable Energy Capacity Statistics 2020". 2020.

International Urban Cooperation, European Union. "City of Solapur delegation visits the City of Murcia to exchange on urban issues". 2018.

IPSOS Global Advisor. "Earth Day 2019: How does the world perceive our changing environment?". 2019.

Kearney. "Harnessing the opportunities in India's transportation infrastructure". April, 2020.

Knight Frank. "Catch Them Moving". 2020.

LiveChennai. "Garbage collection in Teynampet, Kodambakkam, etc to be carried out by Urbaser". December, 2019.

Ministry of Foreign Affairs, European Union and Cooperation. "Hermanamiento Murcia-Solapur". July, 2018.

Ministry for the Ecological Transition and the Demographic Challenge. "Estudio Ambiental Estratégico: Plan Nacional Integrado de Energía y Clima 2021-2030". January, 2020.

Ministry of Urban Development, Government of India. "Guidelines for twinning of cities,". No.N-11025/26/2011-UCD. 2014.

Mint. "How Young India navigates the urban commute". September, 2018.

National Statistical Office, Ministry of Statistics and Programme Implementation, Government of India

"EnviStats India 2020: Vol.1 Environmental Statistics". 2020a.

"Energy Statistics 2020". 2020b.

Roca Gallery. "El proyecto del Río Yamuna, clave para el futuro". September, 2018.

Siemens Gamesa.

"Siemens Gamesa cierra su primer proyecto comercial híbrido eólico-solar en India". September, 2017.

"Siemens Gamesa refuerza su liderazgo en India con el lanzamiento de su aerogenerador más potente en este mercado". July, 2020.

Smart Cities World. "Jaipur hosts India's first Smart City Expo". September, 2018.

Solarpack. "Solarpack se adjudica en India un contrato PPA aumentando su cartera contratada en 396 MW". June, 2020.

SolidWasteIndia. "Chennai hires Spanish firm to manage waste collection and transportation". December, 2019.

Spain-India Council Foundation.

"Indra y la Confederación de la Industria India diseñarán modelos de smart city". November, 2015.

"Misión a India del sector eólico navarro". November, 2016.

"Tecnología de Siemens España para el metro de Nagpur". February, 2017.

"ACCIONA Ingeniería lidera un proyecto entre la UE e India". March, 2017.

"Abengoa se adjudica un contrato de depuración de agua en India". January, 2019.

"Acciona organiza un taller de urbanismo sostenible en India". May, 2019.

The Hindu. "CM launches solid waste management project in 7 zones". October, 2020.

The Times of India. "Metro lines cover only 3% of Gurugram". August, 2019.

United Nations University. "The global e-waste monitor 2020: Quantities, flows and circular economy potential". 2020.

Verisk Maplecroft. "US tops list of countries fuelling the waste crisis". July, 2019.

Windar Renovables. "Windar India: Tower Manufacturing Company 2016". October, 2016.

World Bank. "Solid Waste Management". September, 2019.

World Resources Institute. "17 Countries, Home to One-Quarter of the World's Population, Face Extremely High Water Stress". August, 2019.